AMENDMENT

Please amend the application as follows:

In the Claims

Please add new Claims 38-94.

Please cancel Claim 1.

Newly Added Claims in Clean Form

38. (New) A tandem time-of-flight mass spectrometer comprising:

a) a pulsed source of ions coupled to a first timed ion extractor positioned to extract ions into a first substantially field free region and to focus ions of a predetermined mass-to-charge ratio range onto a focal plane;

b) an ion fragmentor in fluid communication with the first substantially field free region;

c) a second substantially field free region in fluid communication with the ion fragmentor;

d) a second timed ion extractor positioned between the ion fragmentor and the second substantially field free region, wherein the second timed ion extractor is positioned to accelerate ions and fragment ions thereof from the ion fragmentor into the second substantially field free region after a predetermined time; and

e) an ion mirror in fluid communication with the second substantially field free region, wherein the ion mirror is positioned to focus onto an ion detector at least a portion of the fragment ions accelerated by the second timed ion extractor into the second substantially field free region.

39. (New) The mass spectrometer of claim 38, wherein the pulsed source of ions comprises a matrix-assisted laser desorption/ionization (MALDI) ion source.

40. (New) The mass spectrometer of claim 38, wherein the pulsed source of ions comprises an injector that injects ions into a field-free region; and

the first timed ion extractor is positioned to extract ions in a direction that is substantially orthogonal to a direction of injection.

41. (New) The mass spectrometer of claim 38 further comprising a timed ion selector positioned to receive ions from the pulsed source of ions, wherein said timed ion selector permits only the ions of the predetermined mass-to-charge ratio range to travel to the ion fragmentor.

42. (New) The mass spectrometer of claim 41, wherein the timed ion selector comprises an ion deflector.

43. (New) The mass spectrometer of claim 42, wherein the ion deflector comprises a pair of deflection electrodes to which a potential difference is applied, the potential difference preventing ions from reaching the ion fragmentor except during the time interval in which ions within the predetermined mass-to-charge ratio range pass between the electrodes.

44. (New) The mass spectrometer of claim 41 wherein the ion deflector comprises two pairs of deflection electrodes, wherein a potential difference is applied to the first pair of deflection electrodes to prevent ions of lower mass-to-charge ratio from reaching the ion fragmentor and a potential difference is applied to the second pair of deflection electrodes to prevent ions of higher mass-to charge ratio from reaching the ion fragmentor.

45. (New) The mass spectrometer of claim 41, wherein the timed ion selector is positioned within the first substantially field free region.

46. (New) The mass spectrometer of claim 38, wherein the first substantially field free region comprises a drift tube.

47. (New) The mass spectrometer of claim 38, further comprising an ion guide positioned in the first substantially field free region.

48. (New) The mass spectrometer of claim 47, wherein the ion guide comprises a guide wire.

49. (New) The mass spectrometer of claim 47, wherein the ion guide comprises a plurality of apertured plates with a positive DC potential applied to every other plate of the plurality of plates and a negative DC potential applied to the intervening plates of the plurality of plates.

50. (New) The mass spectrometer of claim 47, wherein the ion guide comprises an RF excited multipole lens.

51. (New) The mass spectrometer of claim 38, wherein a substantially field free region is positioned between the ion fragmentor and the second timed ion extractor.

52. (New) The mass spectrometer of claim 38 further comprising a power supply in electrical communication with the ion fragmentor that is adapted to modify the energy of ions entering the ion fragmentor.

53. (New) The mass spectrometer of claim 38, wherein the ion fragmentor comprises a gas collision cell.

54. (New) The mass spectrometer of claim 38, wherein the ion fragmentor comprises a photodissociation cell.

55. (New) The mass spectrometer of claim 38, wherein the fragmentor comprises a surface induced dissociator, wherein ions collide with a solid or liquid surface.

56. (New) The mass spectrometer of claim 38, wherein the second substantially field free region comprises a drift tube.

57. (New) The mass spectrometer of claim 38, wherein the second substantially field free region comprises an ion guide.

58. (New) The mass spectrometer of claim 57, wherein the ion guide comprises a guide wire.

59. (New) The mass spectrometer of claim 57, wherein the ion guide comprises a plurality of apertured plates with a positive DC potential applied to every other plate of the plurality of plates and a negative DC potential applied to the intervening plates of the plurality of plates.

60. (New) The mass spectrometer of claim 57, wherein the ion guide comprises an RF excited multipole lens.

61. (New) The mass spectrometer of claim 38, wherein the predetermined time is such that the second timed ion extractor focuses ions in a selected mass-to-charge ratio range onto a second focal plane.

62. (New) The mass spectrometer of claim 61, wherein the second substantially field free region has an entrance and the second focal plane is positioned to substantially coincide with the entrance.

63. (New) The mass spectrometer of claim 38, wherein the predetermined time is such that the second timed ion extractor focuses ions in a selected mass-to-charge ratio range such that the focused ions arrive at the ion detector in a time interval that is substantially independent of their velocity when exiting the ion fragmentor.

64. (New) The mass spectrometer of claim 38 further comprising a power supply in electrical communication with the second timed ion extractor that is adapted to apply and rapidly change an electrical potential on the second timed ion extractor.

65. (New) A tandem time-of-flight mass spectrometer comprising:

a) a pulsed source of ions that focuses ions of a predetermined mass-to-charge ratio range onto a focal plane;

b) a first substantially field free region positioned to receive at least a portion of the ions of the predetermined mass-to-charge ratio range;

c) an ion fragmentor spaced apart from the pulsed source of ions and positioned to receive at least a portion of the ions that enter the first substantially field free region, wherein the ion fragmentor is adapted to modify the kinetic energy of the ions entering the ion fragmentor;

d) a timed pulsed extractor spaced apart from and in fluid communication with the ion fragmentor, wherein the timed pulsed extractor accelerates the ions of the predetermined mass-to-charge ratio range and fragment ions thereof after a predetermined time; and

e) a time-of-flight analyzer in fluid communication with the timed pulsed extractor and adapted to determine the mass-to-charge ratio of ions accelerated by the timed pulsed extractor.

66. (New) The mass spectrometer of claim 65, wherein the pulsed source of ions comprises a matrix-assisted laser desorption/ionization (MALDI) ion source with delayed extraction.

67. (New) The mass spectrometer of claim 65, wherein the pulsed source of ions comprises an injector that injects ions into a field free region and a pulsed ion extractor that extracts the ions in a direction that is orthogonal to a direction of injection.

68. (New) The mass spectrometer of claim 65 further comprising a timed ion selector positioned to receive ions from the pulsed source of ions, wherein said timed ion selector permits only the ions of the predetermined mass-to-charge ratio range to travel to the ion fragmentor.

69. (New) The mass spectrometer of claim 68, wherein the timed ion selector is positioned within the first substantially field free region.

70. (New) The mass spectrometer of claim 68, wherein the timed ion selector comprises an ion deflector.

71. (New) The mass spectrometer of claim 68, wherein the timed ion deflector comprises a pair of deflection electrodes to which a potential difference is applied, the potential preventing ions from reaching the ion fragmentor except during the time interval in which ions within the predetermined mass-to-charge ratio range pass between the electrodes.

72. (New) The mass spectrometer of claim 68, wherein the timed ion deflector comprises two pairs of deflection electrodes, wherein a potential difference is applied to the first pair of deflection electrodes to prevent ions of lower mass-to-charge ratio from reaching the ion fragmentor and a potential difference is applied to the second pair of deflection electrodes to prevent ions of higher mass-to-charge ratio from reaching the ion fragmentor.

73. (New) The mass spectrometer of claim 65, wherein the first substantially field free region comprises a drift tube.

74. (New) The mass spectrometer of claim 65 further comprising an ion guide positioned in the first substantially field free region.

75. (New) The mass spectrometer of claim 74, wherein the ion guide comprises a guide wire.

76. (New) The mass spectrometer of claim 74, wherein the ion guide comprises a plurality of apertured plates with a positive DC potential applied to every other plate of the plurality of plates and a negative DC potential applied to the intervening plates of the plurality of plates.

77. (New) The mass spectrometer of claim 74, wherein the ion guide comprises an RF excited multipole lens.

78. (New) The mass spectrometer of claim 65 further comprising a grid positioned between the ion fragmentor and the time pulsed extractor, the grid being biased to

produce a substantially field free region between the ion fragmentor and timed pulsed extractor.

79. (New) The mass spectrometer of claim 65, wherein said ion fragmentor comprises a gas collision cell.

80. (New) The mass spectrometer of claim 65, wherein said ion fragmentor comprises a photodissociation cell.

81. (New) The mass spectrometer of claim 65, wherein said ion fragmentor comprises a surface induced dissociator, wherein ions collide with a solid or liquid surface.

82. (New) The mass spectrometer of claim 65, wherein the ion fragmentor is adapted to reduce the kinetic energy of the ions before they enter the ion fragmentor.

83. (New) The mass spectrometer of claim 65 further comprising a power supply in electrical communication with the ion fragmentor that is adapted to modify the energy of ions entering the ion fragmentor.

84. (New) The mass spectrometer of claim 65, wherein the time-of-flight analyzer comprises a drift tube and an ion detector.

85. (New) The mass spectrometer of claim 84, wherein the drift tube includes an ion guide.

86. (New) The mass spectrometer of claim 85, wherein said ion guide comprises a plurality of apertured plates with a positive DC potential applied to every other plate of the plurality of plants and a negative DC potential applied to the intervening plates of the plurality of plates.

87. (New) The mass spectrometer of claim 85, wherein the ion guide comprises an RF excited multipole lens.

88. (New) The mass spectrometer of claim 84, wherein an ion mirror is interposed between said drift tube and said detector.

89. (New) The mass spectrometer of claim 65, wherein the timed pulsed extractor comprises a delayed extraction ion source for the time-of-flight analyzer whereby ions are focused in time so that ions of each mass-to-charge ratio entering the time-of-flight analyzer arrive at the detector within a narrow time interval substantially independent of their velocity when exiting the ion fragmentor.

90. (New) A tandem time-of-flight mass spectrometer comprising:

a) a pulsed source of ions;

b) a timed ion selector positioned to receive ions from the pulsed sources of ions, wherein the timed ion selector permits only the ions of the predetermined mass-to-charge ratio range to travel through an ion fragmentor;

c) a timed pulsed extractor spaced apart from and coupled to the ion fragmentor by a substantially field free region, wherein the timed pulsed extractor accelerates the ions of the predetermined mass-to-charge ratio and fragment ions thereof after a predetermined time; and

d) a time-of-flight analyzer in fluid communication with the timed pulsed extractor, wherein said time-of-flight analyzer determines the mass-to-charge ratio of the fragment ions accelerated by the time pulsed extractor.

91. (New) The mass spectrometer of claim 90, wherein the pulsed source of ions focuses ions of a predetermined mass-to-charge ratio range onto a focal plane.

92. (New) The mass spectrometer of claim 91, wherein the ion fragmentor has an entrance and an exit and the focal plane is positioned to substantially coincide with the exit of the ion fragmentor.

93. (New) The mass spectrometer of claim 92, wherein the timed ion selector is within the ion fragmentor and proximate to the entrance of the ion fragmentor.